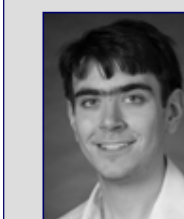


Decision-Making by Technical Expert Committees for Engineering Systems

David Andre Broniatowski, PhD in Engineering Systems (expected in 2010)

Committee: Prof. Chris Magee, chair; Prof. Maria Yang; Dr. Joe Coughlin



Biography
David Broniatowski is expecting to complete his Ph.D. in Engineering Systems before June 2010. His research focuses on the impact of multi-stakeholder decision-making on the diffusion of innovations in health care. He also has strong interests in modeling intercultural collaboration and negotiation. He has worked at the Center for Strategic and International Studies, the X-Prize Foundation, NASA, and the Avidyne Corporation.

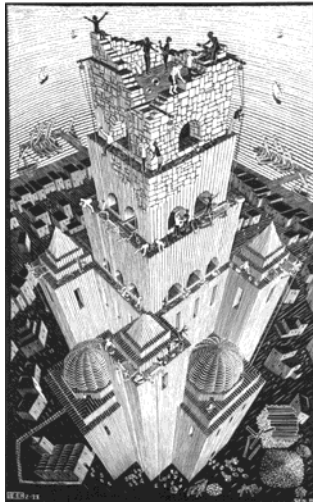
Related Publications
Broniatowski, D.A., "A Method for Generating Social Networks from Meeting Transcripts," Workshop on Modeling Intercultural Collaboration and Negotiation (MICON) at the IJCAI, Pasadena, CA, July 2009.
Broniatowski, D.A., Coughlin, J., Magee, C.L., and Yang, M., "Quantitative Analysis of Group Decision Making for Complex Engineered Systems," 3rd Annual IEEE Systems Conference, Vancouver, Canada, March 2009.
Broniatowski, D.A., Magee, C.L., Coughlin, J.F., and Yang, M., "The Influence of Institutional Background on the Approval of Engineered Systems," 6th Conference on Systems Engineering Research, Los Angeles, CA, April 2008.

Multi-Stakeholder Decisions in Engineering Systems

Large-scale engineered systems are too complex for one individual to comprehend

Insufficient cognitive capacity of one architect
Necessitates creation of **multiple specialties**

- Each specialist has **expertise** from a **different domain**
- Specialized **training** leads to **acculturation** in professional **institution** (Douglas 1986)
- Each expert possess **different views** and **languages**



System is **"boundary object"** and **boundaries** are **contested** (Carille and Schoonhoven 2002; Jasanoff 1987)

Approach: Studying Institutional Background via Language

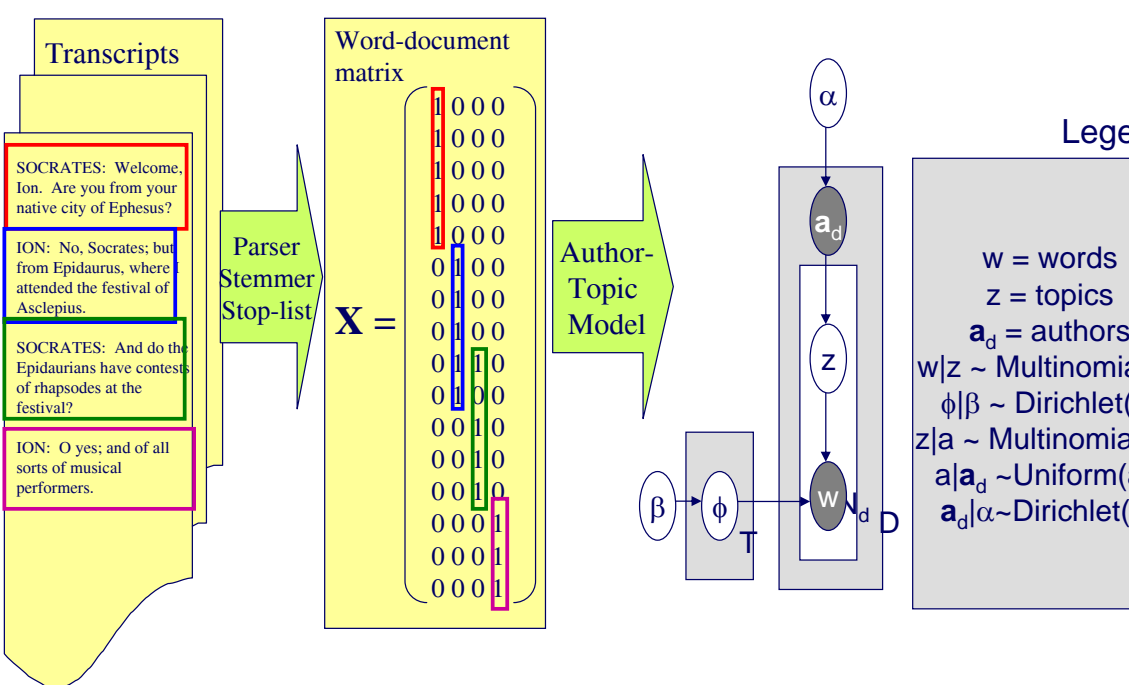
Group membership influences perception of data (Douglas and Wildavsky 1982; Elder and Cobb, 1983)

Group membership **is reflected in language** (problem definition; jargon; symbolic redefinition) (Douglas and Wildavsky 1982; Cobb and Elder, 1983; Elder and Cobb, 1983; Nelson 2005)

Analysis of language use patterns **provides insight into institutional frames** (Nelson 2005; Cobb and Elder, 1983; Elder and Cobb, 1983)

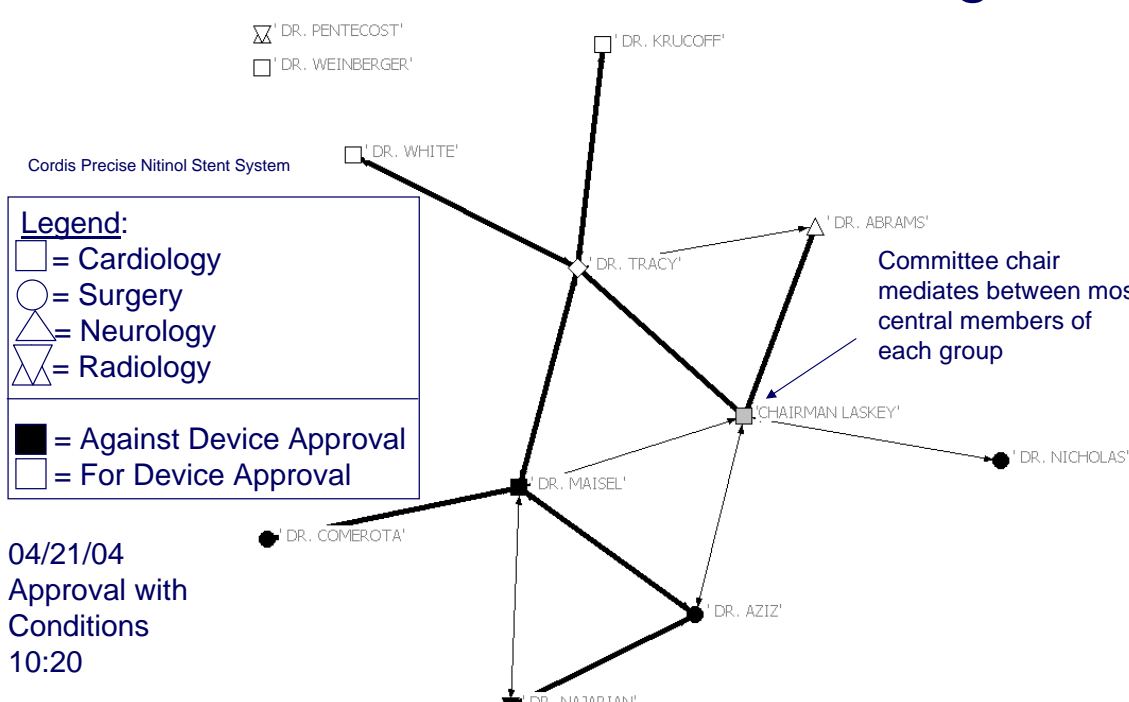
Use **Natural Language Processing** algorithms to uncover patterns—e.g., **Bayesian Topic Models** (Blei, Ng & Jordan 2003)

The Author-Topic Model (Rosen-Zvi et al., 2004)



Legend:
w = words
z = topics
a_d = authors
w|z ~ Multinomial(φ)
φ|β ~ Dirichlet(β)
z|a ~ Multinomial(a)
a|a_d ~ Uniform(a_d)
a_d|α ~ Dirichlet(α)

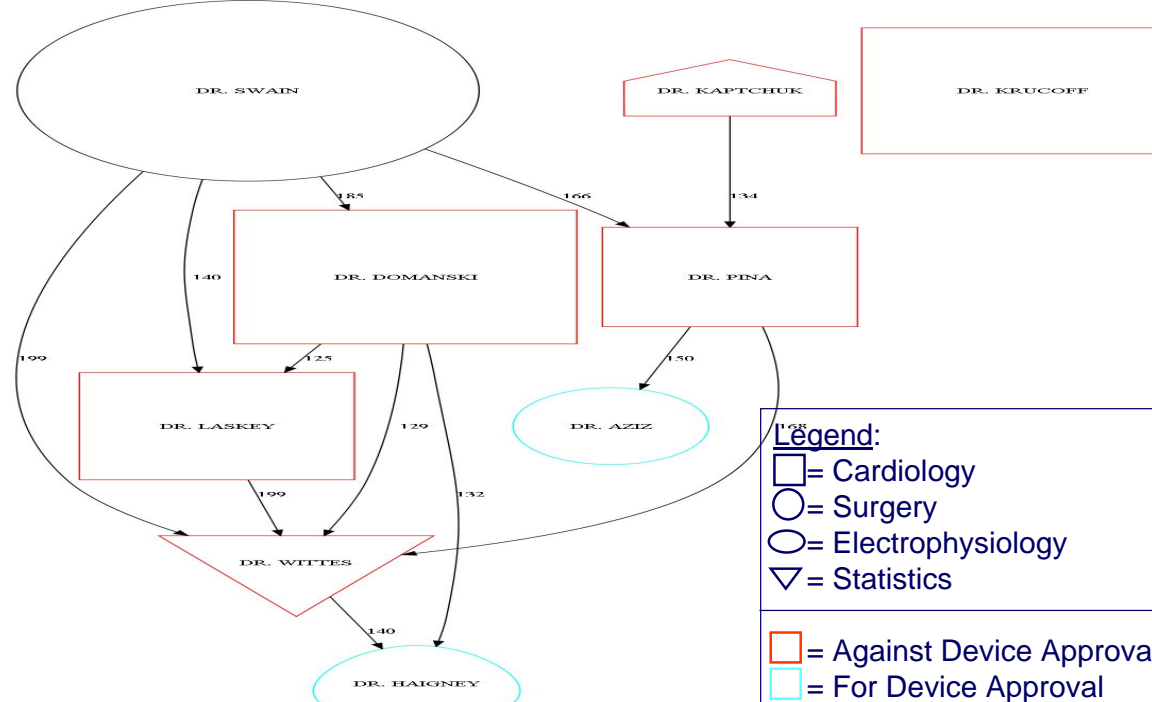
Topics Suggest Social Network Structure for Panel Meeting



Legend:
□ = Cardiology
○ = Surgery
△ = Neurology
▽ = Radiology
■ = Against Device Approval
□ = For Device Approval

04/21/04
Approval with
Conditions
10:20

Incorporation of Time Allows Extraction of Meaningful Hierarchy



Legend:
□ = Cardiology
○ = Surgery
○ = Electrophysiology
▽ = Statistics
■ = Against Device Approval
□ = For Device Approval

Summary

Future Work:
Network Analysis enables hypothesis testing – e.g., are more interdisciplinary members on specialty boundaries? Who are the most central members and why?

Expected Contributions:
Methodological: Algorithms and method for the analysis of expert committee decision making via language
Theoretical: New insights into group decision-making focusing on linguistic sources of influence.
Practical: Policy recommendations for how best to structure approval committees to enable medical device safety and efficacy while still promoting innovation

For more information, please visit:
<http://seari.mit.edu>